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Post processing for FDM printed parts

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Surface Finishes for CNC Machining

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A comprehensive guide describing the range of post-processing options for FDM printed parts



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Introduction

FDM 3D printing is best suited for cost effective prototypes produced with short lead time. Layer lines are generally present on FDM prints making post processing an important step if a smooth surface is required. Some post processing methods can also add strength to prints helping to mitigate the anisotropic behavior of FDM parts.

This article will discuss the most common FDM post processing methods.





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Post processed FDM prints (from left to right): Cold welding, gap filling, unprocessed, sanded, polished, painted and epoxy coated.

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Support Removal

Support removal is typically the first stage of post-processing for any 3D printing technologies that require support to accurately produce parts. Support can generally be separated into 2 categories; standard and dissolvable. Unlike the other post-processing methods discussed in this article support removal is a mandatory requirement and does not produce an improved surface finish.

Standard support removal





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Original print with support attached, poor support removal and good support removal (left to right)

Tool kit

- Needle-nose pliers
- Dental pick set

Process: Support material can generally be removed from the print with little effort, and cleaning of support material in hard to reach places (like holes or hollows) can be achieved with dental picks and needle-nose pliers. Well placed support structures, and proper print orientation, can greatly reduce aesthetic impact of support material on the final print.

Pros

- + Does not alter overall geometry of part.
- + Very quick.

Cons

- Does not remove any layer lines, striations, or blemishes on the print surface.
- If support structures leave behind excess material or marks, the accuracy and appearance of the print is diminished.



Tolerances

★ ★ ★ ★ ★

Speed

★ ★ ★ ★ ★

Suitable for

All FDM thermoplastics

Dissolvable support removal

Tool kit

- Solvent-safe container
- Solvent
- Ultrasonic Cleaner (optional)

186
Shares

Process: Standard dissolvable support materials are removed from a print by placing the print in a bath of the appropriate solvent until the support material dissolves. The support is typically printec in:

- HIPS (usually associated with ABS)
- PVA (usually associated with PLA)
- HydroFill

Glass storage containers, like a mason jar, make excellent vessels for dissolving with Limonene. For dissolving in water, any non-porous container will work. For HIPS/ABS prints, a bath in a 1:1 ratio of (R)-(+)-limonene and isopropyl alcohol works very well for rapid support removal. Many other support materials, such as PVA (used with PLA) and HydroFill (PLA and ABS), simply dissolve in plain water.

Pro-tip: Speed up the dissolving time of soluble support material by using an ultrasonic cleaner, and changing the solvent solution once it becomes saturated with dissolved support material. Using a warm (not hot) solvent will also speed up dissolving time if an ultrasonic cleaner is not available.

Pros

- + Allows for complex geometries where standard support removal would be impossible.
- + Results in a smooth surface where support structure is in contact the part.

Cons



- Improperly dissolving soluble material in solvents can result in bleaching and warping of the print.
[Case 3:19-cv-04753 Document 1-51 Filed 02/05/19 Page 7 of 10 PageID: 741](#)
- Does not remove any layer lines, striations, or blemishes on the print surface.
- Can result in small divots or holes in the final print if soluble material has leaked onto the object during printing.

Finish	★★★☆☆
Tolerances	★★☆☆☆
Speed	★★★★☆
Suitable for	All FDM thermoplastics

186
Shares

93

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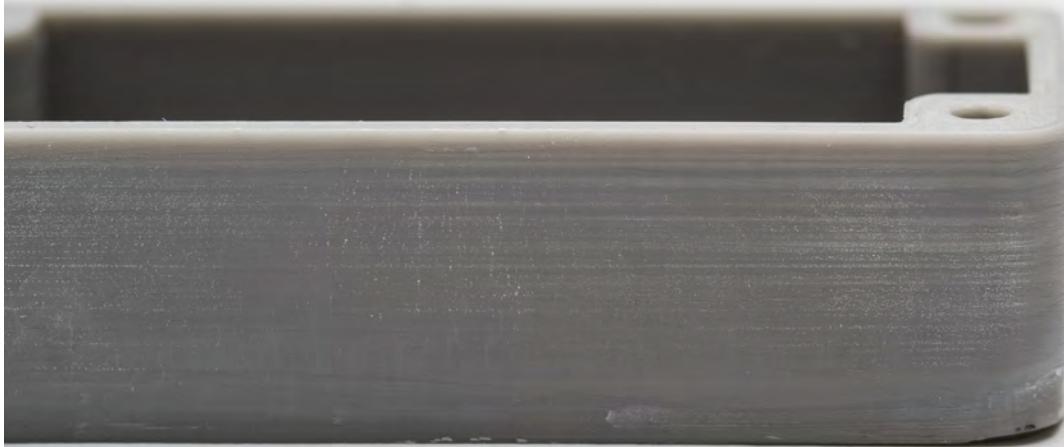


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Sanding





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A sanded grey ABS print

Tool kit

- 150, 220, 400, 600, 1000, and 2000 grit sandpaper
- Tack cloth
- Toothbrush
- Soap
- Face mask

Process: After supports are removed or dissolved, sanding can be done to smooth the part and remove any obvious blemishes, such as blobs or support marks. The starting grit of sandpaper depends on the layer height and print quality; for layer heights of 200 microns and lower, or prints without blemishes, sanding can be started with 150 grit. If obvious blemishes are present, or the object was printed at a layer height of 300 microns or higher, start sanding with 100 grit.

Sanding should proceed up to 2000 grit, following common sanding graduations (one approach is to go from 220 grit to 400 grit, to 600 grit, to 1000 grit and finally 2000 grit). It is recommended to wet sand the print from start to finish, to prevent friction and heat build-up from damaging the part and keep the sandpaper clean. The print should be cleaned with a toothbrush and soapy



Pro-tip: Always sand in small circular motions evenly across the surface of the part. It may be tempting to sand perpendicular to print layers, or even parallel to the print layers, but this can cause “trenches” to form in the part. If the part discolors, or if there are many small scratches from sanding, a heat gun can be used to gently warm the print and soften the surface enough to “relax” some of the defects.

Pros

- + Produces extremely smooth surface finish.
- + Makes additional post-processing (such as painting, polishing, smoothing, and epoxy coating) very simple.

Cons

- Not recommended for prints with 2 or less perimeter shells, as the sanding process can damage the print.
- Difficult for intricate surfaces, and prints with small details.
- Can impact overall accuracy of the print if sanding is done too aggressively and too much material is removed.

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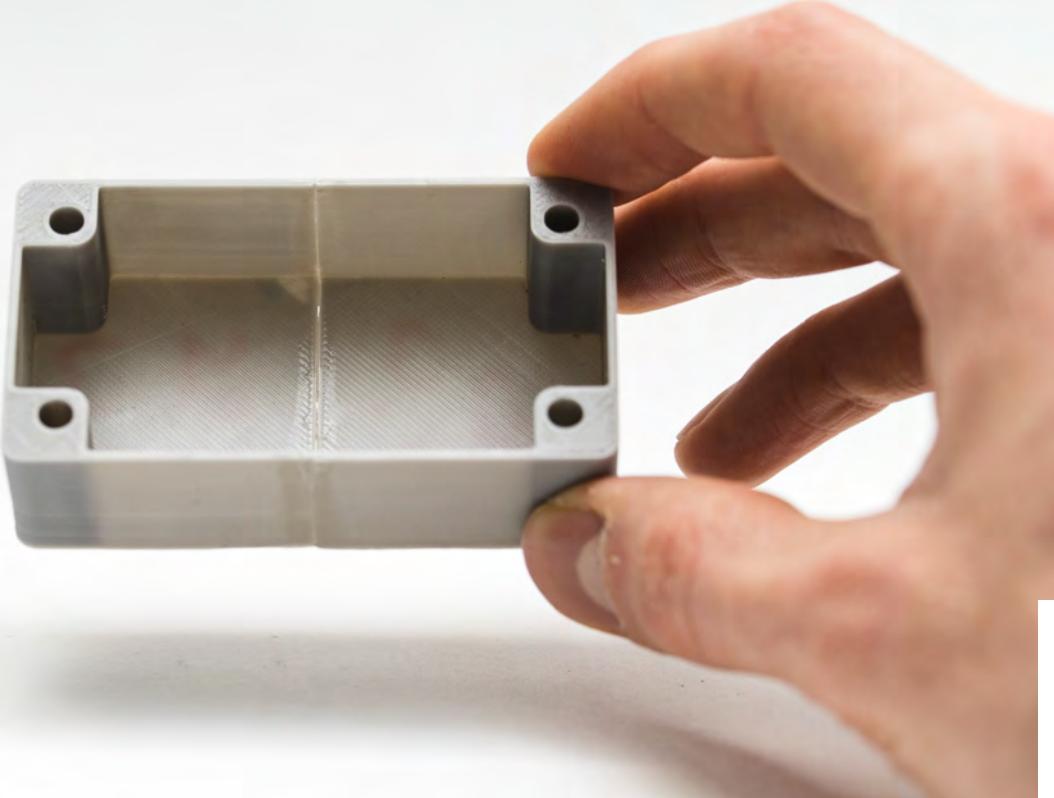
Shares

93

Finish	★★★★☆
Tolerances	★★★☆☆
Speed	★★☆☆☆
Suitable for	All FDM thermoplastics

Cold welding





186
Shares

93

Two grey ABS print halves attached together by cold welding

Tool kit

- Acetone
- Foam applicator

Process: When the size of a print exceeds the maximum volume of the printer, the design is often broken down into smaller sections and assembled together after printing. For PLA and other materials, assembly can be done using Bond-O or an appropriate glue (glue selection will depend upon plastic). For ABS, multi-part assemblies can be “welded” together using acetone. The mating surfaces need to be brushed lightly with acetone, and firmly held together, or clamped if possible, until the majority of the acetone evaporates. At this point, the two parts are chemically bonded to one another.

